

A1.04-8648 – Solid State Multiwavelength Lidar for Volcanic Ash Monitoring

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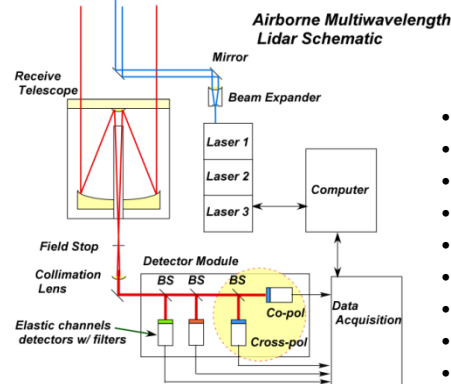
Identification and Significance of Innovation

- Physical Sciences Inc. proposes to develop a compact, multiwavelength Lidar with polarization analysis that can identify volcanic ash plumes at distance.
- A compact system will be developed for airborne deployment, including Unmanned Aerial Systems.
- The system takes advantage of solid-state laser transmitters such as metal doped fiber amplifiers for compactness and reliability.
- A UAS-equipped with such a LIDAR could provide valuable supplementary information to that available from existing and planned satellite assets for defining and tracking volcanic ash plumes.

Expected TRL Range at the end of Contract (1-9): 3

Technical Objectives and Work Plan

- The technical objectives of the Phase I program were to:
 - establish operating parameters for a multiwavelength backscatter Lidar via modeling
 - create a conceptual design for a compact airborne Lidar payload.
- The Work Plan included these tasks:
 - System Modeling. Modeling of backscatter coefficient as a function of wavelength to determine optimal wavelengths.
 - Conceptual Prototype System Design.
- Principal results
 - Modeling revealed useful size information obtainable from backscatter ratio of 0.5 to 1.5 μm returns.
 - Backscatter modeling showed 10 $\mu\text{J}/\text{pulse}$, 1 kHz rep rate enables ranging to 10 km for 1 sec average and 20 cm scope.
 - Raman scattering can be done with 10 mJ/pulse.
 - Conceptual design for field prototype sensor completed



- Low power, high rep rate lasers
- 3 wavelengths (0.5, 1.0, 1.5 μm)
- Polarization analysis
- Uniaxial design
- Single photon detection with APDs
- Athermal telescope
- Stabilized transmit/receive optics
- Dynamic beam alignment
- Eye safe

NASA and Non-NASA Applications

- Applications of a compact multiwavelength Lidar include monitoring transport of volcanic ash plumes and certain icing conditions for aircraft safety, and monitoring Asian dust and biomass burning plumes for studies related to climate change and human health.
- The multiple wavelengths enable an estimate of the mass loading.
- The system is sufficiently compact for airborne or ground deployment. All solid state construction minimizes maintenance.

Firm Contacts

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NON-PROPRIETARY DATA